

Electric Cooling Fan Problems

BY PAUL WEISSLER

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It's a really, really warm day, but the temperature gauge reads normal and the a/c is blowing out a lot of cold air, so who cares? Then the traffic suddenly slows to a crawl and doesn't get any better. Gradually the temperature gauge needle creeps toward the Hot end of the dial, and the air blowing out of the a/c registers is anything but cold. In fact, to forestall overheating, you shut it off. Even worse, you soon have to turn on the heat to try to prevent a boil-over, and open the windows to try to get a breeze.

If you're lucky, the traffic tie-up breaks, and you're cruising again. The gauge needle starts dropping, and you turn off the heater. Still sweaty, you turn on the a/c again, and even if the air isn't frigid, it's cold enough to make you feel better.

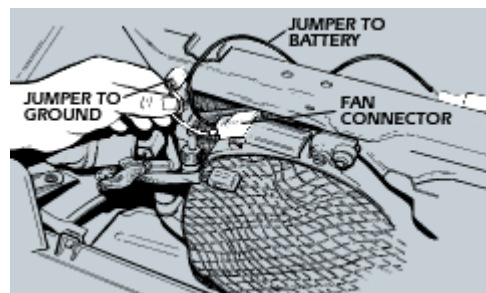
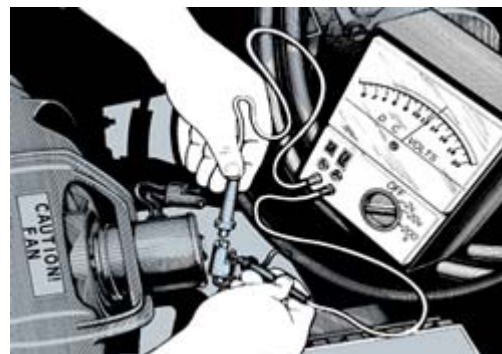
Later, you lift the hood with the engine running near an overheat and the a/c on-the radiator electric fans aren't running. But why? The fan may be under the complex control of a powertrain computer, but the basic circuit is pretty straightforward.

On almost all cars the fans should go on if the a/c is turned on, triggered by the powertrain computer or by an a/c pressure switch. The fans may not go on instantly, but certainly within a couple of minutes. If they don't, proceed to a circuit diagnosis.

The simplest first circuit check you can make is the current feed, starting at the fuse, which on late models is in an underhood fuse box. Just pull it out and look. Replace it if it's blown. On older models it's often a fusible link-a short section of wire typically four gauge numbers higher than the wire of which it's part. You may see it's singed. Even if it isn't, pull on the ends of the wrap, and if it stretches, the wire underneath is broken.

Checking The Fan Motors

Fuse okay? The most practical approach is to go next to the end of



Try jumping the battery direct to the fan to see if it spins.

the circuit: the fans themselves. Most cars have two fans. Unplug one fan's wiring connector and (referring to the wiring diagram color codes) hot-wire the fan motor's half of the connector. Run one jumper wire from the current feed terminal of the connector half to the battery's positive terminal. Attach a second jumper wire to the other terminal of the connector and run it to an electrical ground. The fan should run. If it doesn't, the fan motor apparently is defective.

Some cars have a single fan that runs at two speeds. In these cases, the connector may have:

Two terminals (one from a dual power feed-through a dropping resistor for low speed and a resistor-bypass circuit for high speed-plus the second one for the ground). There's a splice or connector for the dual power feed earlier in the circuit. If you check by hot-wiring at the fan motor itself, it will run at high speed.

Three terminals (one for low-speed feed, one for high-speed and a common ground). Check each power feed terminal separately, using the common ground in each case.

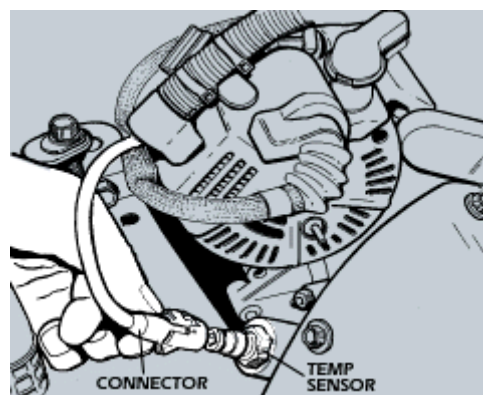
Four terminals (high, low and two grounds). Hot-wire each pair separately with your jumper wires.

Testing Coolant Switch Or Sensor

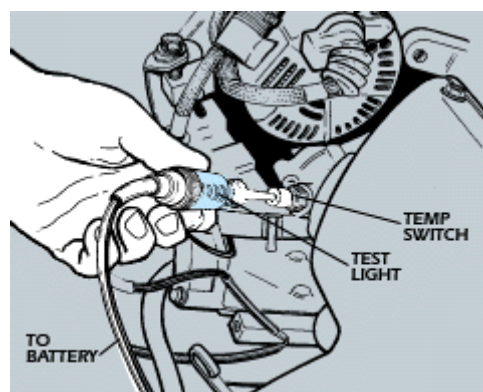
If both fans run when they're hot-wired, the problem is somewhere between the current feed at the fuse and the fan motors. On systems where the trigger for the fans is a coolant temperature switch, unplug the switch connector. Be sure you have the right one, as some vehicles have as many as three: one for a dashboard warning light, one for an overhead console and one for the powertrain computer.

With the engine running and with the coolant switch unplugged, the fan should come on because the powertrain computer logs a trouble code for a failed switch and turns on the fans in most systems. If it doesn't, and the switch is a typical domestic design, it has a normally open type that stays open until coolant temperatures are high, when it closes to turn on the fan. To double-check, just ground the unplugged connector's single wire terminal, using a jumper wire. The fan should spin. Many Japanese cars have circuits with normally closed switches. They open with high coolant temperatures to turn on the fan, so a simple unplugging (with the ignition on) always should get the fans to operate with this setup.

Most late models have a coolant temperature sensor. It isn't a switch, but a temperature-sensitive resistor (thermistor) that sends a signal to the powertrain computer. The computer, which also has some control over a/c operation, then decides when the fans should



There may be several temperature sensors and switches on the engine. Find the correct one and check it with a test light or an ohmmeter.



operate and at what speed. You may not be able to get a response by simply unplugging the sensor connector or even by grounding it. Instead, check its calibration by connecting an ohmmeter. The thermistor develops lower resistance as the temperature goes up, higher resistance as it drops. If the sensor reads a thousand ohms or more (which signals low temperature) when the engine coolant is warmed up, it's out of calibration. Replace it.

Relay Diagnosis

Head for the fan relay (or relays--some systems have low- and high-speed fan relays). Turn on the ignition, and locate the relay terminal for the wire from the switch. When you ground its terminal with a jumper wire, the relay should click and the fan should run. If it does, the relay and its circuit to the fans are good. Any problem is in the wiring between the coolant temperature switch and the relay.

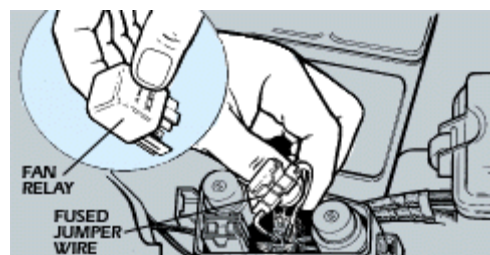
If the fan still won't spin, continue at the relay, which has two current feeds, one to the electromagnetic coil, one to the electrical contacts. Probe the two current feed terminals of its wiring connector with a grounded test light. With the ignition on, it should go on in both cases. No light in one? There's a break in the wiring from the fuse to that relay terminal.

On systems with computer control via a sensor signal, make a similar test of the relay current feed terminals with a grounded test light and the ignition on.

If the current feeds are good, ground the relay's switch terminal (the one with the wire that goes to the coolant switch). If there's a sensor and the switch terminal wire goes to the powertrain computer, unplug the wire before grounding the terminal. The relay should click and operate the fans. If it doesn't, replace the relay.

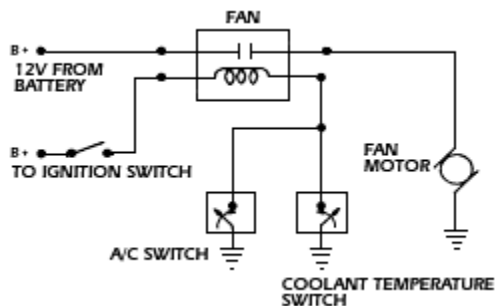
You may have trouble doing this with relays that plug into an underhood relay "center." Unplug the relay, turn on the ignition and with your test light probe the two current feed terminals in the relay center. If they pass (turning on the test light), make up short jumper wires to connect to the unplugged relay and one long jumper (that you run to an electrical ground) for the switch terminal. If the relay still doesn't work (ignition on), replace the relay. If the relay does click, probe the output terminal to the fan motor with a grounded test light. Light goes on? The problem is in the wiring from relay to fan motor.

Your diagnosis may point to the powertrain computer. It's rare, but a computer failure can be responsible--without a Check Engine light or trouble code. Perhaps just a single driver has blown, so the computer itself seems to be performing normally. In addition, in a number of cars, particularly GM models, the powertrain computer turns off the fans if the vehicle is cruising 40 to 45 mph or higher. This strategy relies on the vehicle speed sensor, which may be



You can jump across the fan relay to confirm the relay's failure.

misbehaving. If your speedometer is way off, or not working at all, it's something to consider if the relay works when grounded. Want to work through one of these problems? Boot up your PM CD-ROM or open your factory service manual, plug in a Saturday Mechanic-level scan tool and go through the trouble-tree diagnostics to find the answer.



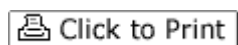
HOW IT WORKS:The Electric Fan

The fan is powered by an electric motor, which is wired to a relay. The relay is a magnetically controlled switch. It typically has four terminals, two of which are current feeds from a fused source of 12-volt electricity. At the relay, there is one current feed into an electromagnetic coil, and one feed into a set of contacts for the switch, which is open. The other terminal for that open switch is connected to the electric motor for the fan. The fourth terminal, also for the coil, is wired to the powertrain computer, which may look at various signals to determine whether or not to provide an electrical ground for that coil. If, as in this circuit example, it gets a high-temperature signal from the coolant temperature sensor, also wired to it, the powertrain computer can choose to ground the coil terminal. This energizes the coil, creating a magnetic field that pulls the arm on the power feed contact, so that it touches the terminal for the wire to the electric motor. That closes the switch of the relay. Current flows through the closed contacts of this switch to the electric motor, which spins to operate the fan.

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